



Project of Strategic Interest NEXTDATA

Scientific report
for the reference period 01 - 01 - 2014 / 31 - 12 - 2014

WP 1.2 GAW-WMO climate observatories

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1. Scheduled activities, expected results and Milestones

Continuation of observation and study activities at the Italian GAW-WMO Global Stations (“O. Vittori” Observatory at Mt. Cimone and Nepal Climate Observatory - Pyramid).

Continuation of the implementation activities concerning atmospheric composition observation programme at the “O. Vittori” M. Cimone Observatory.

Provision of support, in agreement with the GAW—WMO Strategic Plan, to the GAW-WMO high altitude remote stations in Italy (Plateau Rosa) and Bolivia (Chacaltaya) as well as at other high altitude stations (e.g. Monte Portella).

Implementation of experimental services for early warning and near-real time data delivery.

The obtained data will be shared by submission to international data-bases and to the NextData General Portal as well as by the participation to meeting, workshop and conferences (es. *GAW-WMO*, *ACTRIS*, *GEO*, *MACC-2*).

2. Deliverables expected for the reference period

D1.2.6: Report about third year activities and data submission to data-bases and NextData General Portal.

D1.2.7: Report about the upgrade of the activities at Italian GAW-WMO/SHARE stations.

3. Activities which have been actually conducted during the reference period

The observations and the study activities have been continued at the GAW-WMO global station Monte Cimone (GAW ID: CMN) and Nepal Climate Observatory – Pyramid (GAW ID: PYR). Within this framework, activities were carried out concerning instrument calibrations and data validations for trace gases (greenhouse and reactive), atmospheric aerosol (chemistry and physics), meteorological parameters and solar radiation fluxes (short-wave and long-wave) observations, according to the guidelines of the GAW-WMO programme.

During the reference period, data of atmospheric composition were submitted to the GAW-WMO reference databases (<http://ds.data.jma.go.jp/gmd/wdogg/>, <http://ebas.nilu.no/Default.aspx>). Data have been shared with the NextData General Portal. Some delay in data validation activities occurred. A detailed overview of data availability and validation is reported by D1.2.6.

Near-real time data delivery were carried out in the framework of WMO SDS-WAS SDS-WAS (Sand and Dust Storm Warning Advisory and Assessment System) and MACC -2 Project as well as in the framework of GAW-WMO for Mt. Cimone observations.

In the framework of the activities relating WP1.2, ISAC-BO personnel, performed regular visits to Global Station “O. Vittori” (Monte Cimone, Italy). The annual calibration campaign at Global Station NCO-P (Himalayas - Nepal) was carried out on spring 2014 by ISAC-BO and URT Ev-K2-CNR personnel.

The near-real time system for the provision of Plateau Rosa surface ozone data to MACC-2 Project has been activated (see MACC-2 web site).

Some upgrades at GAW-WMO stations with Italian management were carried out during the third year of NextData, even if the lack of expected funds significantly limit the execution of implementation activities. In particular, thanks to the collaboration with ENEA-UTMEA a surface ozone measurement programme has been activated at **Lampedusa** WMO/GAW station. The ozone instrument (Thermo Tei49i) was intercompared against the reference

laboratory (Thermo 48iPS) installed at the ISAC-CNR laboratories in the framework of Nextdata. ISAC-CNR also implemented the instrument data acquisition system at Lampedusa.

In particular **at Monte Cimone** the following measurement programs have been started:
IN-SITU CONTINUOUS MEASUREMENTS OF SULFUR DIOXIDE (SO₂)

IN-SITU CONTINUOUS MEASUREMENTS OF NITROGEN OXIDES (NO_x), NITRIC OXIDE (NO) AND NITROGEN DIOXIDE (NO₂)

Moreover, the implementation phase of the following measurement programme has been carried out:

AEROSOL OPTICAL DEPTH (test at the ISAC Bologna laboratories)

AEROSOL VERTICAL PROFILES BY LIDAR (in-situ test at the Mt. Cimone station)

At **Nepal Climate Observatory-Pyramid** the following new observation systems has been implemented:

- CONTINUOUS OF (SO₂) SULFUR DIOXIDE MEASUREMENTS

In collaboration with CNR-IRSA, within the GAW/WMO programme, the chemistry and the isotopic composition (stable isotopes of oxygen and deuterium) of wet deposition were investigated at the Pyramid International Laboratory.

3.1 Research Activities

At the **Nepal Climate Observatory – Pyramid (NCO-P)**, an instrument "state of the art" for the continuous monitoring of SO₂ has been installed on October 2014. The instrument is based on the UV-fluorescence detection technique. The instrument has been equipped by an automatic system for the execution of daily zero checks. The first two months of continuous measurements indicated that the SO₂ mixing ratios appeared to be for the most part of time below the detection limit (0.10 nmol/mol). With the aim of capitalizing on this instrument, the possibility to move it to the Kathmandu station (WP1.1.) is under investigation. During May 2014, a maintenance campaign was undertaken at NCO-P for the checking and calibration of the experimental set-up. Technicians and researchers from URT Ev-K2-CNR, ISAC BO, CNRS and the Pyramid personnel, participated in this campaign. A complete rearrangement of the NCO-P laboratories has been carried out, allowing a better logistic organization of the instrumentation and technical systems. The ozone analyser was intercompared by using a "twin" instrument sent from Italy. Unfortunately, due to a pump failure, this second ozone instrument was not installed at the observatory as expected. Taking advantage of the scheduled inspection, ISAC-BO personnel also assessed the results of the major technical interventions carried out at NCO-P

Science papers and conference presentations concerning the investigation of atmospheric composition variability at NCO-P have been produced (see Section 3.5 and 4.2).

The instrument PFR (Precision-Filter-Radiometer), recommended by GAW-WMO SAG/Aerosols for the continuous measurements of AOD has been purchased to be installed at the **Mt. Cimone Global GAW/WMO Station**. The solar tracker necessary for the automatic functioning under unmanned conditions is currently under implementation at the ISAC laboratories in Bologna: preliminary operative test at Mt. Cimone are planned for June 2015.

In collaboration with the EU Project ACTRIS, the system for the measurement and the investigation of NO_x at the GAW/WMO Global Station Monte Cimone was installed on March 2014. The system is based on a commercial instrument which has been modified with the purpose of reaching the Data Quality Objective indicated by ACTRIS/GAW/WMO for

“enhanced” measurement sites. This system was coupled with a calibration device with gas phase titration and dilution. A procedure has been carried out for the execution of automatic calibration of NO and NO₂. On March 2014, the new system for the detection of SO₂ measurements has been installed at Mt. Cimone. The preliminary data are currently used for the redaction of the Seasonal Reports about atmospheric composition variability at Mt. Cimone (see <http://www.isac.cnr.it/cimone/reports>). Submission to GAW-WMO is expected for year 2015 for NO-NO₂, while SO₂ data were already submitted to WDCGG.

The LIDAR system developed at the ISAC Laboratories in Rome was already installed at the “O. Vittori” Station for the execution of pre-operational test. In particular, a specific-designed quartz window equipped with heating and thermal/water insulation was installed on the station roof. During the pre-operational tests, some spurious signals affected the signal, thus further refinements was executed to the optical system. The routinely activation of the LiDAR system is foreseen for summer 2015.

3.2 Applications; technological and computational aspects

Proof of concept for a solar tracker to be implemented for on-line AOD measurements at a remote site has been produced.

Software for the automatic execution of calibration for nitrogen oxides (NO_x), nitric oxide (NO) and nitrogen dioxide (NO₂) suitable for remote unmanned high-mountain stations.

A special housing with quartz window for the execution of lidar measurements in extreme weather conditions has been implemented.

3.3 Formation

During the maintenance campaign at NCO-P (Nepal), activities devoted to the training of local staff were continued with the aim of increasing their ability to manage and maintain the experimental instrumentation.

3.4 Dissemination

None

3.5 Participation in conferences, workshops, meetings

DUST 2014, 1st International Conference on Atmospheric Dust, Castellaneta Marina, 1-6 June 2014.

European Geoscience Union General Assembly 2014, Vienna, Austria, 27 April - 2 May 2014.

13th IGAC Science Conference on Atmospheric Chemistry, Brazil, Natal 22-26 September 2014.

4. Results obtained during the reference period

4.1 Specific results (Data libraries, Measurements, Numerical simulations, etc)

Activities at the GAW-WMO global station Monte Cimone and Nepal Climate Observatory – Pyramid, resulted in a data-base concerning meteorological parameters, trace gases mixing ratios and atmospheric aerosol. Observations have been submitted to GAW WDCGG and EBAS.

4.2 Publications

CRISTOFANELLI P. et al., (2014): Transport of short-lived climate forcers/pollutants (SLCF/P) to the Himalayas during the South Asian summer monsoon onset. *Environ. Res. Lett.*, 9 084005.

PUTERO D., LANDI T.C., CRISTOFANELLI P., MARINONI A., LAJ P., DUCHI R., CALZOLARI F., VERZA G.P., BONASONI P., (2014): Influence of open vegetation fires on black carbon and ozone variability in the southern Himalayas (NCO-P, 5079 m a.s.l.), *Environmental Pollution*, 184, 597-604.

CRISTOFANELLI P., SCHEEL H-E., STEINBACHER M., SALIBA M., (2014): Long-term surface ozone variability at Mt. Cimone WMO/GAW global station (2165 m a.s.l., Italy). *Atmospheric Environment*, 101:23-33.

BONASONI P., CRISTOFANELLI P., MARINONI A., DUCHI R., CALZOLARI F., ROCCATO F., PUTERO D., LANDI T.C., Busetto M., Bourcier L., et al., (2014): SPRING 2014 REPORT. Summer report of the Italian Climate Observatory "O. Vittori" at Mt. Cimone.

SANDRINI S., GIULIANELLI L., DECESARI S., FUZZI S., CRISTOFANELLI P., MARINONI A., BONASONI P., CHIARI M., CALZOLAI G., CANEPARI S., PERRINO C., AND FACCHINI M. C., (2014): In situ physical and chemical characterization of the Eyjafjallajökull aerosol plume in the free troposphere over Italy. *Atmos. Chem. Phys.*, 14, 1075-1092. DOI:10.5194/acp-14-1075-2014.

4.3 Availability of data and model outputs (format, type of library, etc)

See Deliverable D1.2.6

4.4 Completed Deliverables

D1.2.6: Report about third year activities and data submission to data-bases and NextData General Portal.

D1.2.7: Report about the upgrade activities at Italian GAW-WMO/SHARE stations.

5. Comment on differences between expected activities/results/Deliverables and those which have been actually performed.

Due to the lack of expected funds for the third years, upgrade activities to Italian GAW-WMO station were limited. The atmospheric composition data observed at NCO-P will be submitted to the ABC-DISC database during year 2014.

6. Expected activities for the following reference periods

Continuation of observation and investigation activities at the GAW-WMO Global Station led by Italian Institutions (implementation of measurement programmes and technological facilities).

Start of upgrade activities at remote GAW-WMO stations in Italy and at other SHARE stations. The scientific community will be informed about the upgrade/implementation activities at the stations. The obtained data will be shared.